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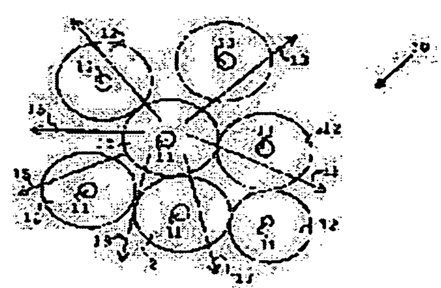
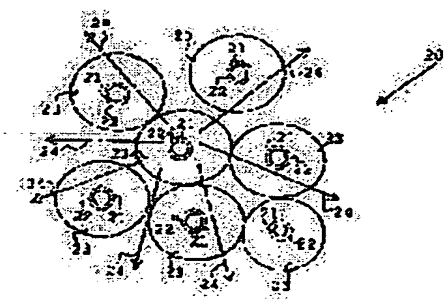
(54) IMPROVED COATED FLUORESCENT FILLER AND METHOD FOR FORMING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a fluorescent filler which enables the production of optical elements such as light-emitting diodes improved in luminous performances and reliability and to provide a method for forming the same.
SOLUTION: The fluorescent fillers (10 and 20) provided are ones containing a plurality of individual fluorescent filler particles (11 and 21) and coating layers (12 and 23) with which the particles (11 and 21) are coated, wherein the coating layers (12 and 23) contain a plastic substance.

(a)



(b)



* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]Fluorescence Fira, wherein it is coated fluorescence Fira, a coating layer with which two or more individual fluorescence filler particles and said fluorescence filler particles are coated is contained and plastic material is contained in said coating layer.
[Claim 2]Coated fluorescence Fira according to claim 1, wherein a transparent epoxy compound is optically contained in said plastic material.
[Claim 3]Coated fluorescence Fira according to claim 1, wherein said fluorescence filler particles are stable fluorescent compound particles.
[Claim 4]Coated fluorescence Fira according to claim 3 if said fluorescence filler particle has little $_3Al_5O_{12}$ (YGd) of which Ce^{3+} addition was done for desirable garnet fellows, wherein other one component is included in it.
[Claim 5]Coated fluorescence Fira according to claim 1, wherein said coating layer is provided [that said fluorescence filler particles are unstable fluorescent compound particles coated with a moisture barrier film, and] in an outer surface of said barrier film.
[Claim 6]Coated fluorescence Fira according to claim 5 if said fluorescent compound particle has little ingredient $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, $S:Eu(Sr, Ca)^{2+}$, and ZnS:Ag, wherein other one is contained in it.
[Claim 7]Coated fluorescence Fira according to claim 5, wherein said barrier film is formed from an inorganic passivation material.
[Claim 8]Coated fluorescence Fira according to claim 7, wherein an aluminum oxide, silicon monoxide, zinc sulfide, or material chosen from a group who comprises silicon nitride is included in said inorganic passivation material.
[Claim 9]Coated fluorescence Fira according to claim 1 if thickness of said coating layer is made 2-6 micrometers, wherein it will be within the limits of 3-5 micrometers.
[Claim 10]Coated fluorescence Fira according to claim 5, wherein thickness of said moisture barrier film is within the limits of 0.1-2 micrometers.
[Claim 11]Coated fluorescence Fira according to claim 5 where thickness of said coating layer is characterized by being twice the thickness of said barrier film at least.
[Claim 12]Coated fluorescence Fira according to claim 5, wherein thickness of said coating layer is 2 to 10 times the thickness of said barrier film.
[Claim 13]Coated fluorescence Fira according to claim 2, wherein a hydrophobic residue which forms a moisture barrier in said epoxy compound is contained.
[Claim 14]A method by which it is a method for forming coated fluorescence Fira, and a step which performs coating by a coating layer which contains plastic material in each of two or more individual fluorescence filler particles is contained.
[Claim 15]That said fluorescence filler particles are unstable fluorescent compound particles and a step which performs coating by a moisture barrier film to said coating step further at said unstable fluorescent compound particle, A method according to claim 14, wherein a step which performs coating by said coating layer to an outer surface of said moisture barrier film is contained.
[Claim 16]A method according to claim 15, wherein said step which performs coating by a moisture barrier film to said unstable fluorescent compound particle is carried out using a wet chemical process.
[Claim 17]A method according to claim 16, wherein said step which performs coating by said coating layer to an outer surface of said moisture barrier film is carried out by making said coating layer laminate physically on said moisture barrier film.
[Claim 18]A method according to claim 15 that inorganic passivation material is characterized by being used as said barrier material.
[Claim 19]A LED tip which is a light emitting diode (LED), is attached to a contact base, and is electrically connected to the 1st and 2nd conductive frame, A light emitting diode, wherein two or more fluorescence filler particles are included, coated fluorescence Fira which covers said LED tip is included and said fluorescence filler particle is coated by coating layer which constitutes plastic material.

[Claim 20]Said LED tip is covered with a guttate thing of said coated fluorescence Fira in a reflective cup provided in said 1st conductive frame, The light emitting diode according to claim 19, wherein the Oba mold by an optical dome by which at least a part of said guttate thing and said 1st conductive frame are optically constituted from transparent epoxy is given.
[Claim 21]At least a part of said LED tip and said 1st conductive frame Said two or more individual fluorescence filler particles, The light emitting diode according to claim 19, wherein an optical dome is formed [that the Oba mold by a mixture of transparent epoxy is given optically, and] with said mixture.
[Claim 22]The light emitting diode according to claim 19, wherein said plastic material is a transparent epoxy compound optically.
[Claim 23]The light emitting diode according to claim 19, wherein said coating layer is provided [that said fluorescence filler particles are unstable fluorescent compound particles to which coating by a moisture barrier film was performed, and] in an outer surface of said barrier film.
[Claim 24]The light emitting diode according to claim 19, wherein said optical dome covers said LED tip and comprises [that an optical dome is contained and] an epoxy material.
[Claim 25]The light emitting diode according to claim 19, wherein an inorganic passivation material is included in said barrier material.
[Claim 26]Into said inorganic passivation material, an aluminum oxide ($aluminum_2O_3$), silicon monoxide (SiO), zinc sulfide (ZnS), Or the light emitting diode according to claim 25, wherein material chosen from a group who comprises silicon nitride (Si_3N_4) is included.
[Claim 27]The light emitting diode according to claim 19, wherein a hydrophobic residue which forms a moisture barrier in said epoxy compound is contained.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]this invention -- an optical element (for example, light emitting diode (LED)) -- it is related with the method for forming fluorescence Fira where business was coated, and coated fluorescence Fira, and the formation method of LED using the coated fluorescence Fira.
[0002]
[Description of the Prior Art]In the case of conventional technology, in a wide range of field of application which attains to a photoluminescence element, fluorescence Fira containing a fluorescence particle is used from electroluminescence devices. this rich applicability is based on existence of a high luminescence yield, a physical characteristic with a preferred fluorescent substance called a long life, and the proper luminescence color in an emission spectrum.
[0003]The application of a light emitting diode (LED) containing the LED tip electrically connected to the conductive contact base as a technical application of such fluorescence Fira which is gaining in importance is mentioned. The LED tip includes the semiconductor p-n

junction which the electron and electron hole which were poured in via service voltage usually recombine by luminescence. Since luminescence is turned to the operable direction of a LED tip, it is possible to include fluorescence Fira which can enclose a LED tip and can usually change the emission spectrum of a LED tip into this optical dome further if needed by the optical dome built with transparent resin.

[0004]That is, it becomes possible to obtain the LED element containing what is called "white LED" that can be competed with the light source of a conventional type in a wide range of applicable fields like a signal and a signboard by development of a blue light LED tip and use of such fluorescence Fira which brings about a wide color range.

[0005]Such fluorescence Fira can use generally the fluorescent compound of a different type, i.e., a stable fluorescent compound and an unstable fluorescent compound, as a base. Since it is comparatively stable, it is possible for the component material of garnet systems, such as $_3Al_5O_{12}$ containing a Ce^{3+} impurity (YGd), to be included as a fluorescent compound considered to be suitable, for example (for example, refer to patent documents 1). (namely, since reactivity is low) On the other hand, it is possible for $SrGa_2S_4$:Eu^{2+}, SrS:Eu^{2+}, S:Eu(Sr, Ca) $^{2+}$, and ZnS:Ag to be included for example, as a fluorescent compound which is not comparatively stable (for example, refer to patent documents 2).

[0006]as [make / advantage / the advantage of fluorescence Fira which takes the gestalt of the particles of a stable fluorescent compound does not react to humidity, but / the reliability of an electric element like the LED tip enclosed with the epoxy dome which constitutes such fluorescence Fira / fall] -- it is in the point to say.

[0007]However, the performance of the electric element provided with the unstable fluorescent compound as everyone knows also in conventional technology can raise the outer surface of fluorescent compound material, i.e., individual unstable fluorescent compound particles, also by performing coating by a protective coating film. That is, said unstable fluorescent compound particle can perform coating by an inorganic coating film containing charges of a water vaporproof barrier material, such as an aluminum oxide (aluminum$_2$O$_3$), zinc sulfide (ZnS), or silicon nitride (Si_3N_4). In the case of such Fira which used the unstable fluorescent compound as the base, it is protected from chemical and the photochemical degradation of a fluorescent compound by the inorganic coating film on individual fluorescent compound particles.

[0008]In view of the above explanation, the term of "fluorescence Fira" expresses the stable fluorescent compound particles to which coating by an inorganic moisture-proof coating film was performed, or two or more fluorescence filler particles which are unstable fluorescent compound particles in the following explanation.

[0009]Although the method for forming a protective coating film on unstable fluorescent compound particles is known from conventional technology literature (refer to patent documents 3), In this case, a protective coating film is formed by performing gaseous phase chemical vacuum deposition (MOCVD= "metal organic chemistry vacuum evaporation") on the fluorescent compound particles currently suspended in the fluid bed by which the temperature gradient is maintained, and said protective coating is a fireproof oxide like an aluminum oxide.

[0010]In other one conventional technology literature (refer to patent documents 4). The method for performing un-granular coating by which silicon, metal like boron, or a semimetal compound followed the surface of individual unstable fluorescent compound particles by a reaction with the polymer which can chelate the ion of metal or semimetal, metal, or semimetal is indicated. a result -- producing -- coating (for example, BA-PVM/MA coating) -- a lamp -- if applied to the inner surface of a cover, it will have adhered to the fluorescent compound particles which show improvement in a lumen maintenance factor chemically.

[0011]To other one conventional technology literature (refer to patent documents 5), un-granular coating by which boron oxide followed individual unstable fluorescent compound particles is performed, and the method of raising the quantum efficiency of fluorescent compound particles under ultraviolet rays (UV) and vacuum-ultraviolet-rays (VUV) excitation is indicated. It is needed for this method to make the oxidizing gas of the fluid bed of a

fluorescence particle react to the catalyst precursor containing boron.
[0012]More generally, although the production method of the microcapsule type conductive filler is indicated by other one conventional technology literature (refer to patent documents 6), this conductive filler is distributed in the one part adhesive of an epoxy type in this case.
[0013]The outline of the structure which has the possibility of fluorescence Fira 100 by conventional technology in drawing 2 (a) is illustrated. In fluorescence Fira 100, two or more unstable fluorescent compound particles 101 are contained.
Coating according [the fluorescent compound particles 101] to the inorganic coating film 102 respectively is performed.
The inorganic coating film 102 comprises a suiting charge of a water vaporproof barrier material like an aluminum oxide (aluminum$_2O_3$), for example, and is about 3-4-micrometer-thick within the limits.
[0014]If the thickness of the coating film 102 is thick, the permeability of light will deteriorate considerably with the coating film 102. On the other hand, if the thickness of the coating film 102 is thin, the interval between the contiguity fluorescent compound particles 101 will become comparatively narrow. Therefore, the light symbolized by the optical beam 103 emitted by LED later mentioned in relation to drawing 2 (b), for example, The luminosity obtained by LED which the probability, as for, resorption is carried out by the surrounding fluorescent compound particles 101 becomes high, therefore uses this kind of fluorescence Fira is insufficient.
[0015]LED tip 201 attached to the 1st conductive frame 202 is contained in typical LED200 which shows drawing 2 (b) an outline. The reflective cup 202a which includes the hollow to which LED tip 201 is attached in said 1st conductive frame 202 is formed. Although at least two electrodes (un-illustrating) which can be considered as a surface mount electrode are attached to said LED tip 201, One side is electrically connected to the 1st conductive frame 202 by the 1st wiring 203, and another side is electrically connected to the 2nd conductive frame 205 by the 2nd wiring 204.
[0016]LED tip 201 is covered with the guttate thing 206 containing epoxy and the mixture which comprises fluorescence Fira distributed in it.
said guttate thing 206 -- the reflective cup 202a -- it is mostly filled up with the whole hollow.
The fluorescent compound particles of fluorescence Fira can perform coating by the coating film containing a charge of a water vaporproof barrier material like an aluminum oxide (aluminum$_2O_3$), i.e., they can form an above-mentioned structure in relation to drawing 2 (a).
[0017]The upper part principal piece of the 1st and 2nd conductive frame 202 and 205 and LED tip 210 covered with the guttate thing 206, and the entire structure formed with the wiring 203 and 204 are enclosed with the optical dome (or optical lens) 207 formed from transparent epoxy.
[0018]As for LED200, it is possible to make it function as a white light emitting diode for example, and the fluorescent compound particles in the guttate thing 206 re-emit yellow, yellow and green, or the red and a green light of a broadband in this case with the blue glow which is not absorbed from LED tip 201.
[0019]The outline of two general methods for forming a LED element is illustrated by drawing 3. Generally these methods are called the "premix method" (drawing 3 (a)) and the "PURIDEPPU method" (drawing 3 (b)).
[0020]In the case of what is called a "PURIDEPPU method" shown in drawing 3 (b), in the 1st step, LED tip 301 of LED element 300 is arranged in the reflective cup 302 of the metal base 303. Next, LED tip 301 is electrically connected to the metal base 303 by the wiring 304. In the following step, the reflective cup 302 is filled up with the guttate thing 305 containing the mixture of the fluorescent compound particles 306 and the epoxy 307, and it covers LED tip 301. Finally, the entire structure of the guttate thing 305, the wiring 304, and the metal base 303 which cover LED tip 301 is given the Oba mold by epoxy, and forms the transparent optical dome 308.
[0021]In contrast with this method, by what is called a "premix method", it is two steps and the procedure which covers LED tip 301 is avoided. In order to realize the simplification of this manufacturing process, as shown in drawing 3 (a), only a single step is realized by the optical dome 309 used as the Oba mold of LED tip 301 containing the mixture in which the fluorescent

compound particles 310 and the epoxy 311 carried out the premix.
[0022]Therefore, according to the premix method of drawing 3 (a), although a manufacturing process is simplified, in being the PURIDEPPU method of drawing 3 (b), the extraction efficiency of the light from LED tip 301 becomes good for the completely transparent optical dome 308.
[0023]However, fluorescence Fira by conventional technology, i.e., coating according to a protective coating film respectively, is not given, or coating only by a single protective coating film was performed (here). An optical element like a light emitting diode (LED) in which a coating film contains the stability or the unstable fluorescent compound particles which comprise an aluminum oxide, for example shows some faults from the following reason. : [0024](1) The basic problem with a serious LED element by the conventional technology of an above-mentioned type is the point of tending to carry out coagulum formation at fluorescent substance Fira, i.e., individual fluorescent compound particles. This problem is observed by the stable fluorescent compound particles and unstable fluorescent compound particles to which fluorescence Fira of all the types mentioned above, i.e., coating by an inorganic moisture-proof coating film, was given, and is equally applied. However, such coagulum formation makes the luminosity of the LED element based on the resorption effect between the uneven spectrum distribution and luminance distribution of the radiated light in the light-emitting surface of a LED element, and the approaching coagulum fluorescence particle produce some faults in a LED element operating characteristic at the time, such as producing a loss.
[0025](2) The optical extraction efficiency which the LED element by conventional technology containing the unstable fluorescent compound particles to which coating by an inorganic film was performed as fluorescence Fira shows is inferior. If it puts in another way, the light volume emitted by such LED element will decrease substantially compared with the light volume emitted by the LED element which does not include such fluorescence Fira. Unlike the refractive index of an epoxy resin as a result, the refractive index of an inorganic coating film [like an aluminum oxide] this [whose] is enters into an enclosure dome, The passing light carries out total internal reflection several times in an inorganic coating film / epoxy interface, therefore is based on the fact of being captured in a dome.
[0026](3) In the case of LED element 200 by conventional technology, the unstable fluorescent compound particles in the guttate thing 206 invade into the guttate thing 206, and show comparatively high reactivity to the humidity which may erode the unstable fluorescent compound particles in it. Therefore, since LED200 receives the influence of degradation, the operational reliability of LED by conventional technology is comparatively low. In a use like the signal in which the life which generally exceeds 10^5 time to the optical element used is demanded, or a signboard, this influence is divided and is disadvantageous.
[0027](4) When that by which individual coating by the protective coating film which comprises an aluminum oxide was performed to unstable fluorescent compound particles, for example is used for the guttate thing 206 of LED200, by protective coating. The optical permeability of the guttate thing 206 falls, therefore the luminosity of LED200 falls. As a result, the thickness of this protective coating, i.e., protection of unstable fluorescent compound particles, will receive restriction.
[0028]As mentioned above, also about extraction of light, i.e., the luminosity of LED, although the performance of LED using fluorescence Fira by conventional technology is divided and is insufficient about a coagulum formation problem, in the case of unstable fluorescent compound particles, it is insufficient at least. Therefore, the reliability of a known LED element is low.
[0029]
[Patent documents 1] JP,10-242513,A[Patent documents 2] JP,2002-60747,A[Patent documents 3] U.S. Pat. No. 4,585,673 specification [Patent documents 4] U.S. Pat. No. 6,001,477 specification [Patent documents 5] U.S. Pat. No. 5,985,175 specification [Patent documents 6] European patent 0th 539 The No. 211B1 specification [0030]
[Problem(s) to be Solved by the Invention]That is, the purpose of this invention is to provide fluorescence Fira which enables production of an optical element like the light emitting diode [LED] (a laser diode is included) luminescent ability and whose reliability improved, and a formation method for the same.

[0031]Other purposes of this invention are to provide a light emitting diode [LED] (or laser diode) luminescent ability and whose reliability improved, and a formation method for the same.
[0032]Other purposes of this invention are to provide fluorescence Fira in which a thing like the epoxy resin of the optical dome of an optical element uniformly distributed in transparent plastic material is possible regardless of any shall be made into the base between the stable fluorescent compound and the unstable fluorescent compound.
[0033]Other purposes of this invention are to provide fluorescence Fira which distributing uniformly is possible, and loses the disadvantageous influence of a thick inorganic coating film on unstable fluorescent compound particles simultaneously, or is reduced at least.
[0034]
[Means for Solving the Problem]According to this invention, coated fluorescence Fira containing two or more individual fluorescence filler particles to which plastic material and coating by a coating layer which has a transparent epoxy compound optically if it can do were performed is provided. Being dispersion which light by which thickness of a coating layer and the material could protect a fluorescence filler particle from outside environment, and wavelength changing was carried out in one fluorescence Fira receives by other particles, and a size which is the grades whose influence of absorption decreases are determined.
[0035]
[Embodiment of the Invention]Fluorescence Fira which serves as a suitable embodiment of this invention with reference to an accompanying drawing below is explained in detail. In coated fluorescence Fira, two or more individual fluorescence filler particles to which coating by plastic material and the coating layer which has a transparent epoxy compound optically if it can do was performed are contained.
[0036]The performance of an optical element like LED improves substantially about optical extraction of a LED element, i.e., a luminosity, and the reliability of a LED element by using fluorescence Fira coated for this structure of coated fluorescence Fira. Other one advantage is a point that the reliability of LED obtained improves by more effective passivation of the individual fluorescence filler particle to an elevated temperature and high humidity.
[0037]The thickness of the coating layer manufactured about the permeability of the light of fluorescence Fira according to one of the embodiments of this invention can increase the distance between adjoining fluorescence filler particles substantially, without degrading the permeability of light, or extraction of light, since it is not restrictive. Therefore, although the coating film by this invention can prevent the coagulum formation between adjoining fluorescence particles, this is a fundamental advantage of coated fluorescence Fira by this invention. The resorption effect between different fluorescence filler particles is inhibited, and the luminescent ability of a LED element improves by using fluorescence Fira where this invention was coated.
[0038]It is possible to improve extraction of light substantially by the optical element using coated fluorescence Fira which was manufactured according to this invention. On the other hand, this effect is acquired by correction of the refractive index produced between an individual fluorescence filler particle and an external epoxy inclusion body. When an "interface" is further formed between an individual fluorescence filler particle and an external epoxy inclusion body by including a transparent epoxy compound optically especially, Since plastic material is contained in the coating layer, the structure by this invention of coated fluorescence Fira is especially advantageous. If it can do, there are this "interface" and an effect which raises the extraction efficiency of an optical element by correction of a refractive index in epoxy / epoxy interface. That is, for example, since the refractive index of the LED tip used is comparatively high compared with the refractive index of a surrounding epoxy compound, if such a correction of a refractive index is another appearance, it is because the Fresnel reflection loss which may become remarkable will be reduced as a result. Therefore, when epoxy / epoxy interface exists further between a LED tip and a surrounding epoxy inclusion body, these Fresnel reflection losses will decrease and extraction of light will increase.
[0039]On the other hand, an extensive improvement of extraction of the light in the optical element using coated fluorescence Fira by this invention originates also in the fact that the

necessity for the thick protective layer which comprises an inorganic passivation material is lost for example. Since such a protective layer with which an individual fluorescence filler particle is coated absorbs most portion of the light emitted with a LED tip, for example, it makes extraction of light get worse substantially as a result. In the case of this invention, even if such a protection passivation layer cannot be found, can be managed by it, or (when fluorescence filler particles are stable fluorescent compound particles). Or it is also possible to make thickness of such a passivation layer thin substantially (when fluorescence filler particles are unstable fluorescent compound particles, an addition corrects and a comparatively thin barrier film is provided between a coating layer and an individual fluorescence filler particle).

[0040]According to one of the suitable embodiments, the fluorescence Fira structure where this invention was coated is applied to the fluorescence filler particle formed of the unstable fluorescent compound particles coated with the moisture barrier film. In this case, the coating layer which contains a transparent epoxy compound optically is coated on a barrier film. For example, if there are little ingredient $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, $S:Eu(Sr, Ca)^{2+}$, and ZnS:Ag, other one can be included by fluorescent compound particles.

[0041]In the structure of coated fluorescence Fira by this suitable embodiment, the basic purpose of a barrier film, Instability individual fluorescent compound particles are protected from the influence of the aging produced with the environment of the surroundings like humidity, change of the chemical composition of unstable fluorescent compound particles is prevented by it, and it is in holding the quantum efficiency.

[0042]However, according to other one suitable embodiment, the fluorescence Fira structure where this invention was coated can also be applied to the fluorescence filler particle formed of the stable fluorescent compound particles which do not need coating by a moisture barrier film. In this case, if a fluorescence filler particle has little $_3Al_5O_{12}$ containing a Ce^{3+} impurity (YGd) for desirable garnet fellows, it is possible to include other one component.

[0043]The basic purpose of a coating layer prevents coagulum formation of a fluorescence filler particle (formed of either of the above-mentioned embodiments), improves extraction of light, and are strength and protecting a barrier film from any chemical decomposition effects further about the luminosity of a LED element. As mentioned above, the further interface will be formed between an individual fluorescence filler particle and an external epoxy inclusion body of a coating layer, and, as a result, it will already be useful for extraction of light, and an improvement of the luminosity of an optical element too by it.

[0044]As for said barrier film, it is desirable to be formed from an inorganic passivation material by which an aluminum oxide, silicon monoxide, zinc sulfide, or the material chosen from the group who comprises silicon nitride can be included.

[0045]Its within the limits of 2-6 micrometers is desirable, and if the thickness of a coating layer is within the limits which is 3-5 micrometers, it is more desirable.

[0046]The thickness of a moisture barrier film has desirable within the limits of 0.1-2 micrometers. That is, the thickness of said coating layer becomes twice [at least] the thickness of said barrier film. Since the coating layer is optically transparent, the thickness of a coating layer is not so critical as the thickness of a barrier film, and since the latter absorbs comparatively a lot of lights emitted with a LED tip, for example, this especially becomes advantageous. On the other hand, since the thickness of a coating layer is thick, it becomes possible to protect an individual fluorescence filler particle from coagulum formation effectively.

[0047]Thickness of said coating layer can also be carried out by 2 to 10 times the thickness of said barrier film.

[0048]As for said fluorescence filler particle, it is desirable to have spherical shape, and preparation procedures become comparatively easy by this. Such shape makes high optical and pack density [being the optimal / in / it is equivalent to geometric structures, and dispersion of a possible light is lessened comparatively, and / a very thin coating layer].

[0049]It is desirable to contain in said epoxy compound the hydrophobic residue which forms a moisture barrier, and to reinforce moisture proof of an individual fluorescence filler particle.

[0050]According to one mode of everything but this invention, a fluorescence filler particle is

coated by the coating layer containing plastic material in the formation method of coated fluorescence Fira containing two or more individual fluorescence filler particles which divides and is used for a light emitting diode.

[0051]According to one of the suitable embodiments, unstable fluorescent compound particles, The step which is used as said fluorescence filler particle and coats further said coating step of said fluorescence filler particle by a coating layer with said unstable fluorescent compound particle with a moisture barrier film, The step which coats the outer surface of said moisture barrier film with said coating layer is contained.

[0052]According to one of the suitable embodiments, said coating step of said unstable fluorescent compound particle by a moisture barrier film is carried out by forming said moisture barrier film chemically in a solution. Said coating step of the outer surface of said moisture barrier film by said coating layer is feasible by making said coating layer deposit physically on said moisture barrier film.

[0053]According to one mode of everything but this invention, to the formation method of a light emitting diode (LED). The step which attaches a LED tip to a contact base, and the step which electrically connects said LED tip to the 1st and 2nd conductive frame, The step covered with fluorescence Fira which had said LED tip coated is contained, and said coated fluorescence Fira contains two or more individual fluorescence filler particles, Coating by the coating layer containing plastic material is performed to that said coated fluorescence Fira receives pretreatment and said fluorescence filler particle.

[0054]According to one suitable embodiment of everything but this invention, unstable fluorescent compound particles, It is used as said fluorescence filler particle, and to said coating step of said fluorescence filler particle by a coating layer. The step which coats said unstable fluorescent compound particle with a moisture barrier film, and the step which coats the outer surface of said moisture barrier film with said coating layer are contained.

[0055]According to other one suitable embodiment, to the step covered with fluorescence Fira which had said LED tip of said 1st conductive frame coated. By the step which distributes the guttate thing of said coated fluorescence Fira to said LED tip in the reflective cup provided in said 1st conductive frame and the optical dome which comprises optically transparent epoxy. The step of said guttate thing and said 1st conductive frame which gives the Oba mold in part at least is contained.

[0056]According to other one suitable embodiment, to the step which covers said LED tip of said 1st conductive frame with coated fluorescence Fira. The Oba mold of said two or more individual fluorescence filler particles, the step which forms a mixture between optically transparent epoxy, said LED tip, and said 1st conductive frame according to said mixture in part at least is given, and the step which forms an optical dome is contained.

[0057]According to one mode of further others of this invention, it divides and the mixture prepared in order to use for a described method is obtained. Said mixtures are said two or more individual fluorescence filler particles and a mixture of optically transparent epoxy, and in this case said fluorescence filler particle, It is convenient as long as it is individually said for every manufacturing process that it is not necessary to prepare a compound required in order to perform coating by the coating layer containing plastic material and to acquire the effect of the above-mentioned request by this invention.

[0058]According to one mode of everything but this invention, to a light emitting diode (LED). The LED tip which was attached to the contact base and was electrically connected to the 1st and 2nd conductive frame, Coated fluorescence Fira which covers said LED tip is included including two or more fluorescence filler particles, and coating by the coating layer in which said fluorescence filler particle contains plastic material is performed.

[0059]According to one of the suitable embodiments, said LED tip, It is covered with said coated fluorescence Fira guttate thing in the reflective cup provided in said 1st conductive frame, The Oba mold by the optical dome which comprises transparent epoxy optically is given to at least a part of said guttate thing and said 1st conductive frame.

[0060]According to other one suitable embodiment, the Oba mold by the mixture of said two or more individual fluorescence filler particles and optically transparent epoxy is given to at least a

part of said LED tip and said 1st conductive frame, and the optical dome is formed in it with said mixture.
[0061]The optical dome which enables protection of the whole structure is obtained without according to other one suitable embodiment, covering said LED tip, comprising an epoxy material, and barring the optical property.
[0062]The effect over the luminescence capability of the structure of the coated fluorescence compound by this invention is shown in drawing 1 (a) and drawing 1 (b) in the form of the schematic diagram.
[0063]The suitable embodiment of coated fluorescence Fira 10 by this invention is shown in drawing 1 (a). If coated fluorescence Fira 10 has little $_3Al_5O_{12}$ containing a Ce^{3+} impurity (YGd) for desirable garnet fellows, two or more stable fluorescent compound particles 11 which can include other one component are contained.
[0064]The individual fluorescent compound particles 11 are provided with spherical shape, and each fluorescent compound particle is within the limits 10**5 micrometers in diameter. As for the fluorescent compound particles 11, coating by plastic material and the coating layer 12 which contains transparent epoxy optically if it can do is performed, respectively. According to this suitable embodiment of this invention, the thickness of a coating film is 3-4 micrometers.
[0065]Coating of the coating layer 12 to an individual fluorescence particle is carried out by making a coating film laminate on individual fluorescent compound particles physically. This is feasible by immersion of the fluorescent compound particles to the inside of epoxy, and the drying period following it, for example.
[0066]Further protection as for the epoxy compound which forms the coating layer 12, it is desirable to include the hydrophobic residue which constitutes an additional moisture barrier, and according to the stable fluorescent compound particles 11 will be performed by this.
[0067]When a fluorescence filler particle is distributed by fluorescence Fira coated by the experiment with the coating film by this invention so that clearly in the epoxy used, for example in order to form the transparent optical dome on a LED tip, there is no tendency which carries out coagulum formation in it.
[0068]Since the coating layer 12 is formed from transparent epoxy material, it does not worsen extraction of the light of an optical element like a LED tip, for example. As shown in drawing 1 (a), the optical beam symbolized by the arrow 13 is extracted from a specific fluorescence particle, without being barred with the surrounding fluorescence particle 11 or the coating film 12. Therefore, the luminosity of an optical element like LED using fluorescence Fira by this invention 10 will improve.
[0069]Other one suitable embodiment of coated fluorescence Fira 20 by this invention is shown in drawing 1 (b). In the case of this embodiment, in coated fluorescence Fira. Two or more unstable fluorescent compound particles 21 are contained, and to these unstable fluorescent compound particles 21. For example, if there are little ingredient $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, S:Eu (Sr, Ca) $^{2+}$, and ZnS:Ag, it is possible for other one to be included.
[0070]If it can do, coating is performed by the charge of a water vaporproof barrier material which individual fluorescent compound particles suit, respectively, and the film 22 which comprises an inorganic passivation material like an aluminum oxide (aluminum$_2O_3$), for example. It is also possible for silicon monoxide (SiO), zinc sulfide, or a passivation material type [other] like silicon nitride (Si_3N_4) to be included in said barrier material.
[0071]It is desirable to carry out coating of the unstable fluorescent compound particles by the moisture barrier film 22 according to what is called a wet chemical process. Although coating by the coating layer 23 to the moisture barrier film 22 is feasible after all by making a coating film laminate on the moisture barrier film 22 physically, This is feasible by immersion of the fluorescent compound particles coated with the film 22 to the inside of epoxy, for example, and the drying period following it.
[0072]According to this invention, it is equivalent to the coating layer 12 in fluorescence Fira 10 where drawing 1 (a) was coated every moisture barrier film 22, and plastic material and coating

by the coating layer 23 which contains transparent epoxy optically if it can do are performed. In one of the suitable embodiments, the functional group containing oxygen of an epoxy compound interacts with the metal ion (for example, Al ion) of a barrier material (for example, an aluminum oxide, aluminum$_2$O$_3$) chemically, namely, produces a chemical bond. As for the coating layer 23, it is desirable to be formed with the hydrophobic epoxy compound which constitutes too the additional moisture barrier which performs further protection to the unstable fluorescent compound particles 21. Therefore, according to this suitable embodiment of this invention, thickness of the barrier film 22 can be made thin compared with the thickness of the barrier film 102 of fluorescence Fira 100 of the conventional technology shown in drawing 2 (a), without degrading moisture proof of the unstable fluorescent compound particles 21. Fluorescence filler particle (here, to a fluorescence filler particle.) the thin barrier film by this suitable embodiment of this invention contains -- having -- since a moisture barrier film becomes thin, an optical element like LED provided with the optical dome which that inside was made to distribute will bring about the outstanding luminescent characteristic.

[0073]Compared with the thickness of said barrier film 22, thick one of the thickness of said coating layer 23 is relatively desirable. Thickness of the coating layer 23 can be increased [of the thickness of said barrier film 22 / twice / at least / or] 2 to 10 times desirably.

[0074]That is, thickness of the moisture barrier film 22 can be considered as the range of about 0.1-2 micrometers, and it is possible for the thickness of the coating layer 23 to be about 2-6 micrometers, and for still more desirable one to set to 3-5 micrometers on the other hand.

[0075]The unstable fluorescent compound particles 21 coated by the moisture barrier film 22 are included like the embodiment shown in drawing 1 (a), The moisture barrier film 22 in fluorescence Fira currently further coated with the coating layer by this embodiment of this invention shown in drawing 1 (b). When a fluorescence filler particle is distributed in the epoxy used, for example in order to form the transparent optical dome on a LED tip, there is no tendency which carries out coagulum formation.

[0076]The distance between the fluorescence filler particle 11, or 21 and 22 which coated fluorescence Fira 10 and 20 adjoins, respectively increases substantially compared with fluorescence Fira by the conventional technology of illustration to drawing 2 (a) so that clearly from drawing 1 (a) and drawing 1 (b). Therefore, the ratio of the light emitted via the gap left behind between 21 and 22 [the surrounding fluorescence filler particle 11 or] (in drawing 1 (a) and drawing 1 (b), respectively) it symbolizes by the optical beam 13 or 24 -- having had -- it becomes high and improvement in the luminosity in LED using fluorescence Fira where this kind was coated will be realized.

[0077]In fluorescence Fira 10 where drawing 1 (a) was coated. Since the stable fluorescent compound particles 11 are contained, therefore a moisture barrier film is not needed for the surroundings of the particles 11, fluorescence Fira 10, High optical permeability is shown compared with fluorescence Fira 20 of drawing 1 (b) containing the unstable fluorescent compound particles 21 to which coating by the moisture barrier film 22 was performed. However, the thickness of the additional barrier film 22 which includes the charge of a water vaporproof barrier material in the case of fluorescence Fira 20 of drawing 1 (b), It is possible to make it thin substantially compared with conventional technology, and it is also possible simultaneously to perform further protection to the unstable fluorescent compound particles 21 by the coating layer 23 to humidity and the ****ing influence of aging.

[0078]Coated fluorescence Fira by this invention can be used for forming an optical element like the white LED of illustration in drawing 2 (b) in relation to drawing 3 (a) and (b) by a conventional method like the above-mentioned "premix" law or "PURIDEPPU" method. Although the performance of such an optical element improves substantially about extraction and the luminosity of the light of an optical element for the structure by this invention of coated fluorescence Fira, it improves substantially also about the reliability of an optical element.

[0079]When it is based on an above-mentioned embodiment and this invention is explained, this invention, It is coated fluorescence Fira, and the coating layer with which two or more individual fluorescence filler particles and said fluorescence filler particles are coated is contained, and fluorescence Fira, wherein plastic material is contained in said coating layer is provided.

[0080]Preferably, a transparent epoxy compound is optically contained in said plastic material.
[0081]Preferably, said fluorescence filler particles are stable fluorescent compound particles.
[0082]Preferably, when said fluorescence filler particle has little $_3Al_5O_{12}$ (YGd) of which Ce^{3+} addition was done for desirable garnet fellows, other one component is included in it.
[0083]Preferably, said fluorescence filler particles' being unstable fluorescent compound particles coated with the moisture barrier film and said coating layer are provided in the outer surface of said barrier film.
[0084]Preferably, other one is contained in it when said fluorescent compound particle has little ingredient $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, S:Eu(Sr, Ca) $^{2+}$, and ZnS:Ag.
[0085]Preferably, said barrier film is formed from an inorganic passivation material.
[0086]Preferably, an aluminum oxide, silicon monoxide, zinc sulfide, or the material chosen from the group who comprises silicon nitride is included in said inorganic passivation material.
[0087]Preferably, 2-6 micrometers, if thickness of said coating layer is made, it will be carried out within the limits of 3-5 micrometers.
[0088]Preferably, the thickness of said moisture barrier film is within the limits of 0.1-2 micrometers.
[0089]Preferably, the thickness of said coating layer is twice the thickness of said barrier film at least.
[0090]Preferably, the thickness of said coating layer is 2 to 10 times the thickness of said barrier film.
[0091]The hydrophobic residue which forms a moisture barrier in said epoxy compound is contained.
[0092]This invention is a method for forming coated fluorescence Fira, and provides the method by which the step which performs coating by the coating layer which contains plastic material in each of two or more individual fluorescence filler particles is contained.
[0093]The desirable thing which said fluorescence filler particles are unstable fluorescent compound particles, The step which performs coating by a moisture barrier film to said unstable fluorescent compound particle, and the step which performs coating by said coating layer to the outer surface of said moisture barrier film are further contained in said coating step.
[0094]Preferably, said step which performs coating by a moisture barrier film to said unstable fluorescent compound particle is carried out using a wet chemical process.
[0095]Preferably, said step which performs coating by said coating layer to the outer surface of said moisture barrier film is carried out by making said coating layer laminate physically on said moisture barrier film.
[0096]Preferably, an inorganic passivation material is used as said barrier material.
[0097]The LED tip which this invention is a light emitting diode (LED), is attached to a contact base, and is electrically connected to the 1st and 2nd conductive frame, Two or more fluorescence filler particles are included, coated fluorescence Fira which covers said LED tip is included, and said fluorescence filler particle provides the light emitting diode being coated by the coating layer which constitutes plastic material.
[0098]Said LED tip is preferably covered with the guttate thing of said coated fluorescence Fira in the reflective cup provided in said 1st conductive frame, The Oba mold by the optical dome by which at least a part of said guttate thing and said 1st conductive frame are optically constituted from transparent epoxy is given.
[0099]Preferably, an optical dome is formed with that the Oba mold according to said two or more individual fluorescence filler particles and the mixture of optically transparent epoxy in at least a part of said LED tip and said 1st conductive frame is given, and said mixture.
[0100]Preferably, said plastic material is a transparent epoxy compound optically.
[0101]Preferably, said fluorescence filler particles' being unstable fluorescent compound particles to which coating by a moisture barrier film was performed, and said coating layer are provided in the outer surface of said barrier film.
[0102]Preferably, further, an optical dome's being contained and said optical dome cover said LED tip, and comprise an epoxy material.

[0103]Preferably, an inorganic passivation material is included in said barrier material.
[0104]Preferably, an aluminum oxide (aluminum$_2O_3$), silicon monoxide (SiO), zinc sulfide (ZnS), or the material chosen from the group who comprises silicon nitride (Si_3N_4) is included in said inorganic passivation material.
[0105]Preferably, the hydrophobic residue which forms a moisture barrier in said epoxy compound is contained.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1](a) shows the suitable embodiment of coated fluorescence Fira by this invention, and (b) is a schematic diagram showing the influence on luminescence capability.
[Drawing 2](a) is a schematic diagram of fluorescence Fira by conventional technology. (b) is a schematic diagram of the light emitting diode (LED) by conventional technology.
[Drawing 3](a) and (b) are the figures showing the alternative embodiment of the method of forming a light emitting diode (LED), respectively.
[Description of Notations]
10 and 20 Fluorescence Fira
11 and 21 Fluorescence filler particle
12, 23 coating layers
22 Moisture barrier film

[Translation done.]

* NOTICES *

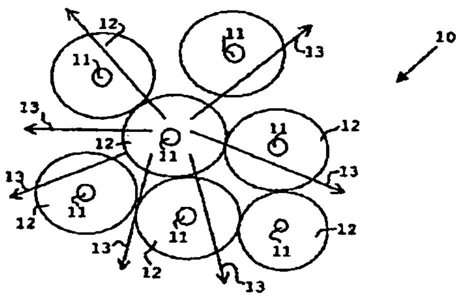
JPO and INPIT are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

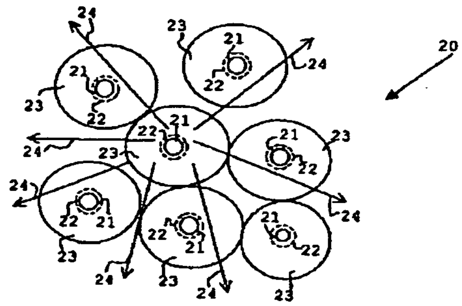
DRAWINGS

[Drawing 1]

(a)

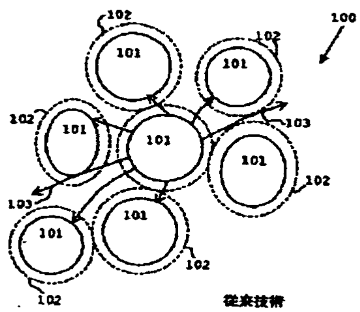


(b)



[Drawing 2]

(a)



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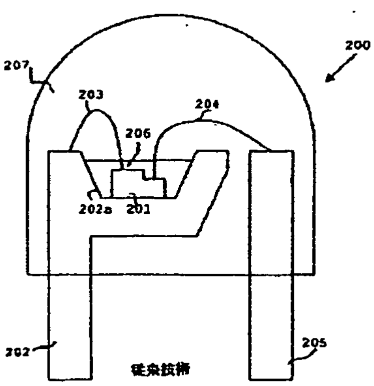
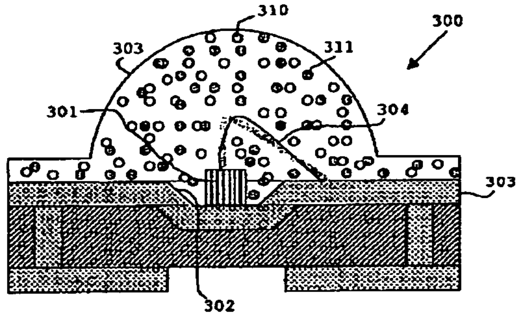


[Drawing 3]

(a)



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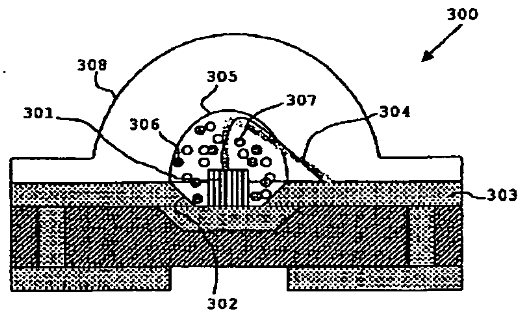
(b)



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[Translation done.]